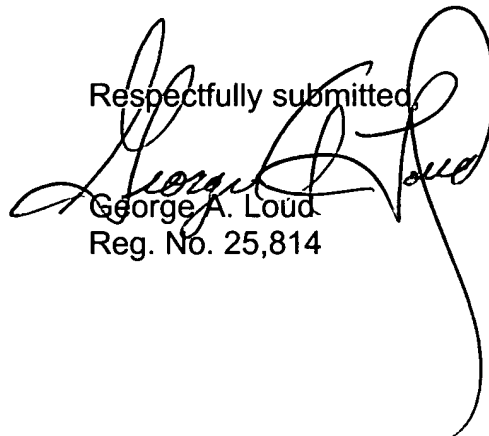


REMARKS

A Substitute Specification and Abstract is submitted herewith to place the case in better English form. The Substitute Specification and Abstract contains no new matter. In order that the examiner can satisfy himself in this regard, also submitted herewith is a marked-up copy of the original Specification and Abstract from which the Substitute Specification and Abstract was typed.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'George A. Loud', is written over the typed name and registration number. The signature is fluid and cursive, with a large loop at the end.

George A. Loud
Reg. No. 25,814

Dated: March 29, 2005

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"joining pole coil" → "multiple coil"

JCO6 Rec'd/PCT/PTO

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Description

COIL FORMING INSERTION DEVICE AND COIL FORMING INSERTION METHOD

Technical Field

The present invention relates to a coil forming ^{and} insertion device and a ^{to} ~~coil forming insertion~~ method for forming a coil ~~used in a motor (electric motor) etc.~~ ^{for} and inserting and arranging this coil in a stator core ^{to be incorporated into an electric motor}.

Background Art

~~For example,~~ ^{for} In the manufacture of a motor having a stator ^{ion of} with slots ~~constructed by inserting~~ plural monopole coils into a slot of the stator core, a ^{multi} joining pole coil ^{is formed} ~~constructed~~ by joining ^{the} a plurality of the ~~above~~ monopole coils. ~~is formed.~~

In a conventional coil forming method, a winder ^{travels} for guiding an electric wire (wire) ~~while winding~~ around a fixed winding frame ~~is used~~, and the electric wire is wound around ^{the} this winding frame and the monopole coil ^{to form} ~~is formed~~. ^{JP-A-2000-253631 discloses a} For example, in Patent literature 1, ^{apparatus including} the outside diameter of the winding frame for ^{winding} winding the electric wire can be changed. ^{and a} A flyer ^{which} as the above winder is rotated around ^{the} this winding frame. The ~~joining pole~~ ^{with joined poles (multiple coil) for} coil ^{is} used in the above motor is formed by sequentially ^{onto} dropping the wound monopole coil ~~to~~ a blade.

"Patent literature 1": JP-A-2000-253631

in the winding apparatus of JP-A-2000-253631

However, ~~in the above patent literature 1~~, when the monopole coil after the ~~above winding operation~~ ^{is} drops ^{ed onto} to the ~~above~~ blade, the monopole coil drops ^{is intended to} into a clearance between needles of the ~~above~~ blade from the ~~above~~ winding frame. ~~Therefore,~~ ^{positioned above the blade}
~~However, there exists the possibility that,~~
✓ in ~~a~~ certain case, there is a fear that ~~no~~ ^{the} monopole coil can not drop to the ~~above~~ clearance. Accordingly, ~~it is not sufficient~~ ^{transfer and mounting of} to reliably move and mount the monopole coil. Further, in ~~the~~ ^{is unreliable} certain case, when the monopole coil drops ^{onto} to the blade, ~~there~~ ^{the} is a fear that the winding order of ~~each~~ ^{the} electric wire ^s in this monopole coil ~~is different~~ ^{will change} from the winding order in which the wires were wound.
~~above winding operation is performed.~~

method of JP-A-2000-253631

Further, in the ~~Patent literature 1~~, after one monopole coil is formed ^{on} in one winding frame, this monopole coil is dropped ^{on} in sequentially ~~wind~~ ^{se} drops ^{on} to the blade. Therefore, there is ~~a~~ ^{the} possibility ^s that the length of ~~a~~ ^{the} connecting wire ^s for connecting the respective monopole coils to each other is dispersed. Further, ^{together will differ}
The ~~joining~~ ^{multi} pole coil having the respective monopole coils joined by the connecting wire ^s is formed on the blade. Accordingly, ~~there is a fear that no forming state of the formed joining~~ ^{the} products may vary.
multipole coil is stabilized.

SUMMARY OF THE INVENTION

~~Disclosure of the Invention~~

~~present~~

The invention is made in consideration of ~~each~~ ^{the problems associated with the} conventional ~~apparatus~~ ^{above-described} and ~~problem points~~ ^{providing a constant}, and provides a coil forming ^{and} insertion device and a coil forming ^{providing a constant} insertion method ~~able to stabilize the length~~.

~~for~~ of the connecting wire ^S ~~for~~ connecting the respective monopole coils, ~~to each other, and able to move and mount the joining~~ ^{Further, the apparatus of the present invention is capable of mounting}

the multi pole coils ~~by~~ approximately simultaneously and reliably delivering each monopole coil to ~~each~~ coil receiving portion ^S without ~~almost~~ ^{any} ~~changing~~ ^{from} the ~~forming~~ ^{in which multi} state of the joining pole coil is ~~formed~~ ^S.

^{In} ~~A~~ first aspect ^{present} of the invention ^{provides} resides in a coil forming ~~apparatus~~ ^{insertion device} comprising a winding jig for forming a ~~joining~~ multi pole coil ~~constructed~~ by joining plural monopole coils, each formed by winding an electric wire ^{on a coil winding frame} in a loop shape, and an inserter jig opposed to the winding jig and receiving the ~~joining~~ ^{multi} pole coil and inserting ^{it} ~~and arranging the joining pole coil~~ ^{to} in a slot ^S formed on the inner circumferential face of a stator core,

~~wherein~~ ^T the winding jig has plural coil winding frames, and the inserter jig has plural coil receiving ^{elements} (portions) for respectively receiving ^{the} each monopole coil ^S from ^{the} each coil winding frame ^S, and

^{No. 11} → Each coil receiving ^{element} ^{arranged} ^a portion is opposed to ~~each~~ coil winding frame, and the ~~joining~~ ^{multi} pole coil, formed by joining ^{the} each monopole coil ^S wound around each coil winding frame, is ~~constructed~~ ^{formed} so as to ^{facilitate transfer} ~~be moved and mounted~~ from the winding jig to the inserter jig.

^{operation of} In the coil forming ^{apparatus} ~~insertion device~~ of the invention, the ~~joining~~ ^{multi} pole coil is formed in the above winding jig and each monopole coil is approximately simultaneously delivered

to ~~each~~ ^{the} coil receiving ~~portion~~ ^{elements} and can be ~~moved~~ ^{transferred} and mounted to the inserter jig as the ~~joining~~ ^{multi} pole coil.

~~Namely, the above winding jig is constructed by arranging the plural coil winding frames, and the joining pole coil can be formed by forming the monopole coil in each coil winding frame in this winding jig. Therefore, each monopole coil can be formed in each coil winding frame in which the mutual positions, relation is fixed. Accordingly, it is possible to stabilize the length of a connecting wire formed between the respective monopole coils wound around the respective coil winding frames.~~

^{Because} ~~each~~ monopole coils ^{are formed} ~~can~~ be formed ^{on} ~~in each~~ coil winding frame ^{s have} ~~in which~~ the mutual ^{fixed} ~~positions,~~ relation is ^{make} ~~fixed.~~ Accordingly, it is possible to ~~stabilize~~ the length of ^{the} ~~a~~ connecting wire ^s ~~formed~~ between the respective monopole coils ^{have the same length.} ~~wound around the respective coil winding frames.~~

~~Further, the above inserter jig has the plural coil receiving portions. When each coil winding frame holding the monopole coil and each coil receiving portion are opposed to each other, each monopole coils can be approximately simultaneously and reliably delivered to each coil receiving portion. Therefore, in this delivery, there is almost no change in which the winding order of each electric wire in each monopole coil is different from the winding order in which the above monopole coils are formed winding operation is performed.~~

~~Further, the above inserter jig has the plural coil receiving portions. When each coil winding frame holding the monopole coil and each coil receiving portion are opposed to each other, each monopole coils can be approximately simultaneously and reliably delivered to each coil receiving portion. Therefore, in this delivery, there is almost no change in which the winding order of each electric wire in each monopole coil is different from the winding order in which the above monopole coils are formed winding operation is performed.~~

Therefore, this joining pole coil can be moved and mounted from the winding jig to the inserter jig without almost changing the forming state of the joining pole coil.

A second aspect of the invention resides in a coil forming insertion device comprising ^{as} ~~a~~ winding jig for forming a joining ~~multi~~ pole coil ~~constructed~~ by joining plural monopole coils ~~each~~

~~formed by winding an electric wire in a loop shape~~, and an inserter jig opposed to the winding jig ^{for} and receiving the ~~joining~~ ^{Multi} pole coil and inserting and arranging the ~~joining~~ ^{Multi} pole coil in a slot ^{for} formed ⁱⁿ on the inner circumferential face of a stator core, wherein the winding jig ^{has} is ~~constructed by arranging plural~~ coil winding frames for forming the monopole coil by winding the electric wire ^{winding axes located} ~~at~~ about the same distance from the central ~~axis~~ ^{axis} ~~point~~ of the winding jig, and ~~is~~ arranged ~~such that respective winding axes for winding the electric wire in each coil winding frame are approximately parallel to each other.~~

The inserter jig has a ^{slidable} ~~pushing-out insertion~~ core for pushing ~~into~~ the ~~joining~~ ^{Multi} pole coil ^{into} toward the slot of the stator core and ~~inserting this joining pole coil into the slot~~, and also has plural coil receiving ^{element} (portions) arranged ^{around} on the outer circumferential face of the ~~pushing-out insertion~~ ^{slidable} core ^{for} and ~~respectively receiving each~~ ² monopole coil from ~~each~~ ² coil winding frame, ~~and~~

When the ~~joining~~ ^{Multi} pole coil is moved ~~and mounted~~ from the winding jig to the inserter jig, each coil receiving portion ^{arranged} is ^{end} opposed to the ~~tip~~ ² face of ~~each~~ coil winding frame ^{and aligned} in the direction of the winding axis, ^{Subsequently,} and each coil winding frame ^{is connected} ~~and~~ ^{to a} each coil receiving portion ~~are connected to each other, and each of each coil winding frame and each coil receiving portion is constructed so as to form a moving and mounting route for~~ ^{surface defining transfer path} ~~moving and mounting each monopole coil.~~ ^{in transfer of same.}

In the coil forming ^{and} insertion device of the invention, ^{second embodiment} as in the first ^{embodiment} the ~~joining~~ ^{multi} pole coil is formed in the above winding jig and each monopole coil is approximately simultaneously and reliably delivered to ~~each~~ ^{the} coil receiving ~~portion~~ ^{elements} and can be moved and mounted ^{on} to the inserter jig, ~~as the joining pole coil~~ ^{of the second embodiment}.

Namely, in the ~~above~~ winding jig, the plural coil winding frames are arranged approximately in parallel with each other ~~and~~ ^{multi} in this winding jig, the ~~joining~~ pole coil ~~can be formed by~~ ^{is} ~~forming the monopole coil in each coil winding frame.~~ Therefore, ~~each~~ ^{winding a} monopole coil ^{is} ~~can be formed in each coil winding frame~~ ^{around} in which the mutual ^{fixed} position ^{is} relation ^{on} is fixed. Accordingly, it is possible ^{to make} ~~to stabilize the length of~~ ^{the} connecting wires ^{of the same length,} ~~formed between the respective monopole coils wound around the~~ ~~respective coil winding frames.~~

Further, the above inserter jig has each coil receiving ^{alignment} portion opposed to the ~~tip~~ ^{end} face of ~~each~~ ^a coil winding frame.

When each coil winding frame and each coil receiving portion ^{they together form a transfer surface/path.} are connected, ~~each coil winding frame and each coil receiving~~ ~~portion can form each moving and mounting route.~~ Therefore,

when each monopole coil is delivered from ~~each~~ ^{its} coil winding frame to ~~each~~ ^{the} coil receiving ~~portion~~ ^{elements}, each monopole coil can be reliably ^{moved} ~~delivered~~ ^{its thus formed transfer path} along each moving and mounting route while ~~each moving and mounting route is maintained within the~~ ^{center} ~~ring~~ of the monopole coil.

Each monopole coil can be approximately simultaneously

delivered to the coil receiving ^{elements} portion. Therefore, in this ^{transfer} delivery, there is almost no case in which the winding order of ^{the} ^{loops} electric wire in each ^{will be changed} monopole coil is different from the winding order in which the ^{monopole coil} ~~above~~ winding operation is ~~per-~~formed.

No 4 → Therefore, ^{the multi} ~~this joining~~ pole coil can be ^{transferred} moved and mounted from the winding jig to the inserter jig without almost ^{any} ~~changing~~ ⁱⁿ the ~~forming~~ state of the ^{multi} ~~joining~~ pole coil.

A third aspect of the invention resides in a coil forming insertion method in which a winding jig for forming ^{and} a joining pole coil and an inserter jig for inserting and arranging the ^{ed monopole} ~~joining~~ pole coil in ^s a slot ^s formed on the inner circumferential face of a stator core are used.

No 4 → Plural monopole coils are formed and ^{joined to form a} ~~the~~ ^{multi} ~~joining~~ pole coil, ^{the} ~~constructed by joining the plural~~ monopole coils ~~is also~~ formed by winding an electric wire around each of plural coil winding frames arranged in the winding jig, ~~and~~

No 4 → ^{on a} Each monopole coil held to ~~each~~ coil winding frame is simultaneously delivered to each of plural coil receiving ^{elements} portions arranged in the inserter jig, and the ^{multi} ~~joining~~ pole coil ^{is transferred} ~~is moved and mounted~~ to the inserter jig.

In the coil forming ^{and} insertion method of the invention, the ^{multi} ~~joining~~ pole coil is formed ^{on} ~~in~~ the above winding jig and each monopole coil is approximately simultaneously delivered to ^{the} ~~each~~ coil receiving ^{elements in transfer onto} portion and can be moved and mounted

to the inserter jig ~~as the joining pole coil~~
~~as in the previously described embodiment~~
Therefore, similar to the above invention, the length
of the connecting wire^s connecting the respective monopole coils
to each other can be ~~stabilized~~ ^{made constant (equal)} and the ~~above moving and mounting~~ ^{transfer}
operation can be performed ~~(without almost changing~~ ⁱⁿ the forming
state of the ~~joining pole coil~~ ^{multiple} by approximately simultaneously
and reliably ~~delivering~~ ^{transferring} each monopole coil to ~~each coil receiving~~
~~portion~~ ^{elements of the inserter jig}.

A fourth aspect of the invention resides in a coil forming
insertion method including a coil forming ~~process~~ ^{step} for forming
a ~~joining pole coil constructed~~ ^{multiple} by joining plural monopole coils
formed by winding ^{loops of} an electric wire ~~in a loop shape~~ in a winding
jig, a ~~coil moving and mounting process~~ ^{transfer step} for moving and mounting
the ~~joining pole coil~~ ^{multiple} from the winding jig to the inserter jig,
and a coil insertion ~~process~~ ^{step} for inserting and arranging the
~~joining pole coil~~ ^{multiple} in a slot ³ formed on the inner circumferential
face of a stator core ^{utilizing} from the inserter jig.

~~wherein~~ ^I In the coil forming process, plural coil winding
frames for forming the monopole coil by winding the electric
wire are arranged approximately ^{in an} ~~in a circumferential shape~~ ^{circular array} and
~~the joining pole coil is formed by using the winding jig constructed~~
~~by arranging respective winding axes for winding the electric~~
~~wire in the respective coil winding frames approximately in~~
parallel with each other, and

^I In the coil ~~moving and mounting process~~ ^{transfer}, ~~the inserter~~

^{in the inserter jig is used}
^{a slidable}
~~jig has a pushing-out insertion core for pushing out the joining~~
~~for insertion into a~~
^{the}
~~multiple pole coil toward the slot of the stator core and inserting the~~
~~joining pole coil into this slot, and also has plural coil receiving~~
~~elements which are~~
~~portions arranged on the outer circumferential face of the~~
~~pushing-out insertion core and respectively receiving each~~
^{the}
~~monopole coil from each coil winding frame, each coil receiving element~~
^{aligned in opposition}
~~portion is opposed to the top face of each coil winding frame, extending~~
~~in the direction of the winding axis and each coil winding frame~~
^{is connected with a}
~~and each coil receiving portion are connected by using the inserter~~
^{The connection of a}
~~jig, and each of each coil winding frame and each coil receiving~~
^{element}
~~portion forms a moving and mounting route for moving and mounting~~
~~each monopole coil, and each monopole coil is delivered from~~
^a
~~each coil winding frame to each coil receiving portion while~~
^{while the transfer path}
~~each moving and mounting route is maintained within the ring~~
^{located}
~~of each monopole coil.~~
^{center}

In the coil forming insertion method of the invention,
 the joining pole coil is formed by using the above winding jig
 in the above coil forming process. In the above coil moving
 and mounting process, each monopole coil is reliably delivered
 to each coil receiving portion and can be moved and mounted
 to the inserter jig as the joining pole coil.

Therefore, ~~similar to the above invention,~~ the length
 of the connecting wire ^{made constant} connecting the respective monopole coils
 to each other can be ~~stabilized,~~ and the above ^{-described transferring} moving and mounting
 operation ^{can} be performed ⁱⁿ without almost changing the forming

state of the ^{multi} joining pole coil ^{is formed} by approximately simultaneously and reliably delivering each monopole coil to ~~each~~ coil receiving ^{elements} ~~portion~~.

④ Insert "B" - pp. 13-21

caps → Brief Description of the Drawings

Fig. 1 is a perspective view ^{as a first embodiment of} showing a coil forming device ^{in accordance with the present invention,} ~~in an embodiment 1.~~

Fig. 2 is a ^{schematic} perspective view showing the coil forming device in a state ^{with} in which a ^{multi} joining pole coil ^{is formed thereon,} ~~is formed by~~ ^{i.e. with a} wound on ^{of} each coil winding frame ^{in the apparatus} ~~in the~~ ^{of the first embodiment.} ~~embodiment 1.~~

Fig. 3 is an ^{a side} ~~explanatory~~ view ^{as a} showing each winding frame ^{with its} ~~in a state in which an~~ outside winding frame portion ~~is located~~ ^{in accordance with} ~~in a winding position, in the~~ ^{first} ~~embodiment, 1.~~

Fig. 4 is an ^{a side} ~~explanatory~~ view ^{of the} showing each winding frame ^{of Fig. 3 with its} ~~in a state in which the~~ outside winding frame portion ~~is located~~ ^{release} ~~in a separating position, in the~~ ~~embodiment 1.~~

Fig. 5 is a perspective view ^{of} showing the coil forming device ^{with} ~~in a state in which~~ the winding axis ^{<1} of a first coil winding frame ^{aligned with} ~~is approximately conformed to the~~ turning central axis of ^{its} a turning arm and ^{with the first coil winding frame} ~~is projected from all the~~ remaining winding frames in the ^{first} ~~embodiment.~~ ^{beyond}

Fig. 6 is a perspective view ^{of} showing the coil forming ^{apparatus} ~~device in a state in which the~~ monopole coil ^{in the process of formation} ~~is formed by~~ winding an electric wire around the first coil winding frame, ~~in the~~

embodiment 1

Fig. 7 is a perspective view showing the coil forming apparatus of the first embodiment with ~~device in a state in which~~ the winding axis of a first connecting wire winding frame ~~is~~ ⁱⁿ approximately ^{alignment with central} ~~conformed to~~ the turning central axis of the turning arm and ~~is~~ ^{showing} projected ^{below} ~~from all~~ the remaining winding frames and the electric wire ~~is~~ ^{being} wound around this first connecting wire winding frame, ~~in the embodiment 1.~~

Fig. 8 is a perspective view showing the coil forming apparatus as the first embodiment with ~~device in a state in which~~ the winding axis of a second coil winding frame ~~is~~ ⁱⁿ approximately ^{alignment with} ~~conformed to~~ the turning central axis of the turning arm and ~~is~~ ^{below} projected ~~from all~~ the remaining winding frames, ~~in the embodiment 1.~~

Fig. 9 is a perspective view showing the coil forming apparatus of the first embodiment with a ~~device in a state in which~~ the monopole coil ~~is~~ ^{formed by winding} the electric wire around the second coil winding frame, ~~in the embodiment 1.~~

Fig. 10 is a perspective view showing the coil forming apparatus of the first embodiment with a ~~device in a state in which~~ a ^{multi} joining pole coil ~~is~~ ^{thereon} formed by winding the electric wire around all the winding frames, ~~in the embodiment 1.~~

Fig. 11 is an explanatory view ~~typically~~ showing a ~~state~~ in which the ^{multi} joining pole coil ~~is~~ formed by winding the electric wire around all the winding frames in the ^{first} embodiment. ~~in the~~

Fig. 12 is an explanatory ^a plan view ^{of the} showing a coil forming apparatus of a second embodiment ~~insertion device in a state in which~~ the ^{multi} joining pole coil is

in the process of being transferred from
moved and mounted from a winding jig ^{onto} an inserter jig, in an
~~embodiment 2.~~

side
Fig. 13 is an explanatory view showing the coil forming ^{apparatus of}
~~the second embodiment~~
~~insertion device~~ in a state in which the winding jig ~~for~~ holding
the ^{multi} pole coil is advanced ^{ing ward} to the inserter jig, in the
~~embodiment 2.~~

Fig. 14 is an explanatory view showing the coil forming ^{apparatus of the}
~~second embodiment~~
~~insertion device~~ in a state in which the ^{end of} tip portion in a coil
^{has been} receiving portion of the inserter jig ^{is} fitted into a fitting slot
~~concave portion~~ in the coil winding frame of the winding jig
~~in the embodiment 2.~~

Fig. 15 is an explanatory view showing the coil forming ^{apparatus of the}
~~second embodiment~~
~~insertion device~~ in a state in which each outside winding frame
^{of} portion in each coil winding frame of the winding jig ^{has been} moved
^{release} to the separating position, and each monopole coil is separated
~~from each coil winding frame in the embodiment 2.~~

Fig. 16 is an explanatory view showing the coil forming ^{apparatus of the}
~~second embodiment~~
~~insertion device~~ in a state in which ^{a piston} an expelling core of the
^{has been} winding jig ^{is} advanced and the ^{multi} pole coil ^{has been} pushed
^{to} out until a prescribing position ^{on} in the inserter jig, in the
~~embodiment 2.~~

Fig. 17 is an explanatory view showing the coil forming ^{apparatus of the}
~~second embodiment~~
~~insertion device~~ in a state in which the winding jig ^{has been} is retreated
from the inserter jig, in the ~~embodiment 2.~~

Fig. 18 is an explanatory view showing the coil forming ^{apparatus of the}

~~second embodiment~~
insertion device in a state in which ~~each~~ ^{the} coil receiving portion
~~of~~ ^{is} in the inserter jig is ~~opposed to the~~ ^{inserted through center} inner circumferential
face of a stator core, ~~in the embodiment 2.~~

~~Fig. 19 is an explanatory plan view showing the coil forming~~
~~insertion device in a state in which each coil receiving portion~~
and ~~each~~ ^{5 of} guide portion in the inserter jig ~~are opposed to the~~ ^{inserted}
~~inner circumferential face of the stator core in the embodiment~~ ^{into as shown in Fig. 18.}

~~Fig. 20 is an explanatory plan view showing the coil forming~~ ^{apparatus}
~~insertion device in a state in which the joining pole coil is~~
inserted and ~~arranged in each slot~~ ^{into the} of the stator core, ~~from the~~ ^{in accordance}
~~inserter jig in the embodiment.~~ ^{with second}

~~Best Mode for Carrying Out the Invention~~

~~The preferred embodiment modes in the invention mentioned~~
~~above will be explained.~~

~~In the above first and second aspects of the invention,~~
It is preferable ^{red} that each coil winding frame has a ^{slot in its end face} fitting
~~concave portion for fitting the tip portion of each~~ ^{receiving} coil receiving ² element.
~~portion onto the tip face, and~~

¹⁵
~~The joining pole coil is moved and mounted from the winding~~
jig to the inserter jig in a state in which ^{multi} the tip portion ^{transferred} of each
of the coil receiving ^{elements} is fitted into the ^{after} fitting concave
~~portion~~ ^{slot} of each coil winding frame.

In this case, each coil winding frame and each coil receiving

portion can be easily and reliably connected to each other by the above fitting, ^{operation} and ^{a transfer surface/path} the above moving and mounting route is easily formed.

Further, it is preferable ^{red that the above-mentioned slots} ~~to form the above fitting concave~~ ^{enabling the} ~~portion~~ ^{have} at a depth able to insert and arrange the above coil ^(elements) ~~to be inserted completely through the central opening~~ receiving portion ² within the entire ring of the monopole coil wound around the above coil winding frame.

^{NO} ~~Thus~~ ^{described connection has been made} In this case, when the above fitting is performed, the ~~tip portion~~ ^{end} of each coil receiving portion is necessarily inserted and arranged within the ^{center} ~~ring~~ of each monopole coil ^{respectively mounted on the} ~~in each coil~~ winding frame. Therefore, each monopole coil can be ~~further~~ ^{transferred} reliably delivered from each coil winding frame ^{the} to ^{the} each coil receiving portion.

It is also preferable ^{red} that the winding jig has ^a ~~an expelling~~ ^{slidably mounted in the center of each coil winding frame} core arranged so as to be advanced and retracted ²⁰ ~~on the inner~~ ^{for pushing the multipole coil from the} circumferential side of each coil winding frame ~~so as to expel~~ ^{onto} the joining pole coil to the inserter jig.

^{NO} ~~In this case, each monopole coil delivered from each coil~~ ^{manner} winding frame to each coil receiving portion is pushed out by the ~~above expelling core~~ ^{the multipole coil to} and can ~~be moved until~~ a predetermined position ^{on} in the ~~above~~ inserter jig.

²⁰ ~~It is also preferable~~ ^{red} that each coil winding frame ^{have} ~~has~~ an ^{inner} ~~inside~~ winding frame portion arranged on the inner ~~circumferential side as the central point side of the winding~~ ^{outer} jig, and an ~~outside~~ winding frame portion ~~opposite~~ arranged,

~~on the outer circumferential side of the~~ ^{inner} ~~inside~~ winding frame portion, and

No. 11 → The outside ^{or} winding frame portion can be moved so as to change ^{its} ~~the~~ distance ^{from} ~~between this outside winding frame portion~~ and the ^{inner} ~~inside~~ winding frame portion ^{is e. moved} between a winding position ^{for} ~~the~~ winding the electric wire and a ^{release} ~~separating~~ position ^{for} separating the monopole coil, after the winding operation ^{has been completed} is performed from the coil winding frame.

cont In this case, ~~when the above~~ electric wire is wound, the ~~above~~ outside winding frame portion is set to be located in ^{its} ~~the above~~ winding position ^(Fig. 3) ~~in~~ each coil winding frame, and it is possible to form the monopole coil ^{with a} ~~of a winding~~ diameter determined by the distance between the outside winding frame portion and the ~~above~~ inside winding frame portion.

Further, when ~~each~~ ^{the} coil winding frame ^{is} ~~is~~ connected to ^{the} ~~each~~ coil receiving portion, ^{elements} each outside winding frame portion is set to be located in ^{its release} ~~the above separating~~ position ^(Fig. 4) in each coil winding frame, and it is possible to separate ^{the} ~~each~~ monopole coils ^{therefrom} ~~from~~ by reducing the distance between each outside winding frame portion and ^{the attached} ~~each~~ inside winding frame portion, Each monopole coil can be further easily delivered from each coil winding frame to each coil receiving portion.

It is also preferable ^{red} that the outside winding frame portion is stepwise increased in diameter toward the advancing direction ^{in a} ~~perpendicular~~ to and away from the turning arm on the side opposed to the inserter jig.

~~In this case, when the above outside winding frame portion~~
~~is set to be located in the above winding position, the monopole~~
~~coil having a winding diameter of the electric wire increased~~
~~toward the above advancing direction can be formed by forming~~
~~a state in which the outside diameter of the coil winding frame~~
~~is stepwise increased toward the above advancing direction.~~
Therefore, when the ^{multi} joining pole coil ^{including} constructed by this monopole
coil is inserted and arranged in the slot ⁵⁰⁵ in a stator core or
a rotor core, this ^{multi} joining pole coil can be collectively inserted
and arranged by locating ^{its} the large ^{diameter} side of the above winding
~~diameter on the opening side of the slot, for inserting and arranging~~
~~the joining pole coil.~~

Further, when the ~~above~~ outside winding frame portion
is ~~set to be located in the above separating position,~~
monopole coil can be easily separated ^{because} by ~~forming a state in~~
~~which~~ the outside diameter of the coil winding frame is reduced
~~toward the above advancing direction.~~ ^{in the} ^{away from the winding jig.}

It is also preferable ^{led} that the winding jig has a turning
arm ^{mounted} arranged so as to be turned ^{about} with a ^{turning} central axis
connected to a turning device ~~as a center~~, and also has an index
holder ^{mounted for rotation relative} rotatably arranged ^{around} with respect to the turning arm in
~~a state in which a rotating central axis formed in a position~~
~~offset approximately parallel with the turning central axis,~~
~~is set to a center,~~

The plural coil winding frames are arranged in the index

holder in an arc shape at about the same distance ^{approximately} ~~from the rotating~~ ^{axis} ~~central axis~~, and the respective winding axes for winding the ^{of rotation} ~~electric wire~~ in the respective coil winding frames are approximately parallel to each other and are also approximately parallel to the ^{of} ~~turning~~ central axis, and

No 2 → Each coil winding frame is ^{mounted for reciprocating movement} ~~arranged~~ so as to be advanced and retreated ^{as being} in the direction of the ~~turning~~ central axis, with ^{In other words, each} respect to the index holder, and the coil winding frame for winding the electric wire is ^{mounted} ~~constructed~~ so as to be advanced ^{an "} ~~in the~~ advancing direction on the side ^{" away from} ~~opposed~~ to the inserter jig with respect to the remaining coil winding frames and is ^{and away from} ~~where it is axially~~ ^{to a position} ~~also constructed so as to be projected from the remaining coil~~ winding frames.

B { ^{To form the multi} ~~In this case, when the above joining pole coil is formed,~~ the ~~above~~ index holder and the ~~above plural~~ coil winding frames ^{together as a unit} ~~are entirely rotated by the above turning arm~~ ^{with only} ~~in a state in~~ which the coil winding frame for winding the ~~above~~ electric wire ^{axially beyond other} ~~is projected from the remaining coil winding frames~~ ^{and the} ~~toward~~ the ~~above~~ advancing direction. The electric wire is wound around ^{one} the ~~above~~ projected coil winding frame. Therefore, ^{unlike the prior art,} ~~no electric~~ ^{there is no use of} ~~wire is wound while rotating a winder~~ ^{around} ~~etc. from the outer~~ circumference of a fixed winding frame, ~~as in the conventional~~ case. Accordingly, each monopole coil can be formed in each ~~coil winding frame~~ ^{imparting} ~~without almost generating torsion in the~~ ^{to} electric wire.

Further, each coil winding frame can sequentially ^{be} ~~approach~~ ^{brought into approximate alignment with} the ~~above turning central axis from the coil winding frame for~~ winding the ~~above electric wire~~ by rotating the ^{ion of} ~~above~~ index holder. Therefore, although the ~~above~~ coil forming ^{apparatus} ~~device~~ has ~~the above plural coil winding frames to form the above joining~~ pole coil, the ~~above~~ electric wire can be wound ^{around} ~~in a state in~~ which the coil winding frame ^{axis with very little} ~~for winding the electric wire is~~ ~~not~~ ^{it} ~~eccentric so much from the above~~ ^{relative to the} turning central axis.

After the monopole coil is formed ^{on} ~~in~~ one coil winding frame, the ~~above~~ index holder is ~~moved~~ ^{rotated to bring adjacent} and the next coil winding frame ^{into approximate alignment with} ~~adjacent to the above one coil winding frame approaches~~ the ~~above~~ turning central axis. ~~Similar to the above case, the~~ ~~monopole coil can be formed.~~

Therefore, the electric wire can be stably wound without changing the ^{from which} ~~supplying direction of~~ the electric wire ^{is supplied} ~~to each~~ coil winding frame ~~so much to wind the electric wire around~~ ~~each coil winding frame.~~ ^{and} ~~Therefore, the monopole coil almost~~ ^{can be formed,} ~~not generated in the above torsion,~~ ^{stably} ~~can be stably formed with~~ ~~respect to any coil winding frame,~~ ^{on} ~~and the joining pole coil~~ ~~almost not generated in the torsion can be stably formed.~~

Further, ~~the coil winding frame for winding the electric~~ ~~wire is projected and the electric wire can be easily supplied~~ to ^{the} ~~this~~ projected coil winding frame from ² ~~the~~ direction perpendicular to its winding axis. Therefore, the electric wire is easily supplied and is also easily wound around the coil

winding frame. Further, it is possible to further ^{improving or} ~~easily form~~ ^{reduce Torsion} ~~in the coil winding operation.~~
~~the joining pole coil in which the above torsion is almost not,~~
~~generated.~~

~~In the above third and fourth aspects of the invention,~~
~~it is preferable that each monopole coil is delivered from each~~
~~coil winding frame to each coil receiving ^{element} ~~portion~~ in a state~~
~~in which the tip portion of the coil receiving portion is fitted~~
~~into a fitting concave portion formed on the tip face of each~~
~~coil winding frame in the coil moving and mounting process.~~

~~In this case, each coil winding frame and each coil receiving~~
~~portion can be easily and reliably connected to each other by~~
~~the above fitting, and the above moving and mounting route is~~
~~easily formed and the above delivery can be performed.~~

~~It is also preferable that an expelling core arranged~~
~~on the inner circumferential side of each coil winding frame~~
~~is advanced in the advancing direction on the side opposed to~~
~~the inserter jig, and each monopole coil delivered to each coil~~
~~receiving portion is pushed out until a predetermined position~~
~~in the inserter jig in the coil moving and mounting process.~~

~~In this case, each monopole coil delivered from each coil~~
~~winding frame to each coil receiving portion is pushed out by~~
~~the above expelling core, and can be reliably moved until a~~
~~predetermined position in the above inserter jig. Further, the~~

~~above ^{mentioned} predetermined position is set to a ^{mutually} ~~prescribing~~ position ^{transferred} set~~
~~for inserting and arranging the ^{mutually} ~~joining pole~~ coil from the above~~

↑

see
p. 13,
line 17
to p. 14
line 1

✓
to p. 14

4
inserter jig ^{into} the slot ^{of} the ~~above~~ stator core. Thus, after the ~~joining~~ ^{Multi} pole coil ^{has been} moved and mounted ^{on} to the inserter jig, the ~~joining~~ ^{Multi} pole coil in this ~~moving and mounting~~ ^{ed} state can be inserted and arranged in the slot ^s of the stator core.

It is also preferable that each monopole coil is separated from each coil winding frame by reducing the outside diameter of each coil winding frame, and each monopole coil is delivered from each coil winding frame to each coil receiving portion in the coil moving and mounting process.

B In this case, the outside diameter of each coil winding frame is set to a regular outside diameter and the monopole coil of the regular size is formed in the above coil forming process. In the above coil moving and mounting process, the outside diameter of each coil winding frame is reduced and the above joining pole coil can be easily separated from each coil winding frame. Each monopole coil can be further easily delivered from each coil winding frame to each coil receiving portion.

It is also preferable ^{red} that, in the coil forming process, the monopole coil having a winding diameter of the electric wire increased toward the advancing direction is formed by forming a state in which the outside diameter of the coil winding frame for winding the electric wire is stepwise increased in the advancing direction on the side ^{and} opposed to the inserter jig,

^{transfer} ^{steps}
In the coil ~~moving~~ and mounting ~~process~~, each monopole

coil is separated from ~~each~~ ² coil winding frame by ~~forming a~~ ^{reducing}
~~state in which~~ the outside diameter of each coil winding frame
is ~~reduced toward~~ ^{in the} ~~the advancing direction.~~ ^{away from the turning arm}

^{Thus} ~~In this case,~~ it is possible to easily form the ~~joining~~ ^{multi-pole}
~~pole coil constructed by~~ ^{of} the monopole coil ^{which} having a winding
diameter of ~~the electric wire~~ increased from one side to the
other ~~side~~. Further, this ~~joining pole coil~~ can be ~~also~~ easily
~~separated.~~ ^{from the winding frame.}

DESCRIPTION OF THE PREFERRED EMBODIMENTS

~~Embodiments~~

^{A first} ~~In the following~~ ^{of} ~~embodiment 1,~~ ^{apparatus} ~~a coil forming device and~~
~~a coil forming method for forming the joining pole coil,~~ ^{with formation of a multi-pole} will now be describ
^{with reference to} ~~be explained by using Figs. 1 to 11, and a coil forming process~~
~~for forming the joining pole coil from the electric wire will~~
~~be explained.~~

^{utilizing a} ~~Further, in the following embodiment 2,~~ ^{now} ~~a coil forming~~ ^{with reference to}
~~insertion device and a coil forming insertion method having~~ ^{in accordance with the second embodiment,}
~~the winding jig and the inserter jig will be explained by using~~ ^{method for transferring}
Figs. 12 to 20. Further, a ~~coil moving and mounting process~~ ^{multi-}
~~for once moving and mounting the joining pole coil held to the~~ ^{on}
winding jig to the inserter jig, and ~~a coil insertion process~~ ^{a method for}
~~for inserting and arranging the joining pole coil from the inserter~~ ^{transferring}
jig ^{into} ~~in each slot~~ ^{multi-} of the stator core will be explained. ^{also}

Further, the winding jig used in ^{this second} ~~the~~ ^{first} ~~embodiment~~ ^{may} is the
same as the winding jig used in the ~~embodiment~~ ^{first}, and ~~will be~~

A
cont
be
reference to
also explained by ~~using one of Figs. 1 to 11, in the embodiment~~
~~2 in a certain case.~~

~~(Embodiment 1)~~

As shown in Figs. 1 and 2, the coil forming device 1 of *the first*
~~embodiment~~ *multipole*
this example forms a ~~joining pole~~ *joining* coil 9 as ~~a coil for a motor~~
~~in which plural monopole coils 90 formed by winding an electric~~
~~wire 99 in a loop shape are joined.~~ The coil forming device
is shown as including
1 ~~has~~ an unillustrated base frame, a turning arm 21 *supported*
~~arranged in this base frame with a turning central axis C2 connected~~
the *for rotation around 2*
~~to an unillustrated turning device as a center, and a winding~~
jig 2. ~~Further, the winding jig 2 has an index holder 22 movably~~ *mounted for movement*
relative
~~arranged with respect to the turning arm 21, and plural coil~~
winding frames 3 arranged *around* *C2* on the outer circumferential face
of ~~this~~ index holder 22.

The
~~Further, each winding axis C1 for winding the above electric~~
wire 99 *around the* *are* ~~in each coil winding frame 3 is mutually~~ approximately
parallel and ~~is~~ also approximately parallel to the *central* ~~above~~ turning
~~central~~ axis C2. The coil forming device 1 is constructed such
that the coil winding frame *3* for winding the above electric
wire 99 can sequentially approach the ~~above~~ *movement of* turning central
axis C2 by ~~moving the above~~ index holder 22.

~~This construction will next be explained in detail.~~

As shown in Figs. 1 and 2, the ~~above~~ index holder 22 is
mounted on
~~rotatably and movably arranged in the above turning arm 21 by~~
for rotation about *ion* *located*
~~setting a rotating central axis C3 formed in a position~~

approximately ~~offset~~ in parallel with the ~~above~~ turning central axis C2 ~~to the center~~. Further, ^{the} each coil winding frame 3 ^{are} arranged ^{on} in the ~~above~~ index holder 22 in an arc shape ^{and spaced} at about the same distance from the ~~above~~ ^{on} rotating central axis C3.

The ~~winding frame~~ distance L1 from the ~~above~~ rotating central axis C3 to the winding axis C1 ^{rotation} ~~in each~~ coil winding frame 3 is set ^{as the} to about the same ^{approximately equal to} as the offset distance L2 from the ~~turning central~~ axis C2 of the ~~above~~ turning arm 21 to the ~~rotating central~~ axis C3 of the ~~above~~ index holder 22.

The winding axis C1 of the coil winding frame 3 ^{for winding} ~~the above electric wire 99~~ can be sequentially ^{moved into} approximately ~~aligned with~~ ^{alignment with} the ~~above~~ turning central axis C2 by rotating the ~~above~~ index holder 22 ^{through} by a predetermined angle with respect to the turning arm 21, and the electric wire 99 can be wound ^{on the thus aligned winding frame.} ~~in this state.~~

Further, a ~~joining pole~~ coil 9 ^{an} joined in the arc shape can be formed by ^{the} each coil winding frame 3 ^s arranged in the ~~above~~ arc shape (see Fig. 11).

As shown in Fig. 3, each coil winding frame 3 is arranged so as to be advanced and retreated ^{acted along} in the ~~direction of the above~~ turning central axis C2, with respect to the ~~above~~ index holder 22. The coil winding frame 3 for winding the above electric wire 99 can be projected ^{relative to} from the remaining coil winding frames 3 by advancing the coil winding frame 3 in the ~~advancing~~ ^{away} direction separated from the ~~above~~ turning arm 21, with respect to the

~~remaining coil winding frames 9.~~ Therefore, the electric wire 99 can be easily supplied to the above projected coil winding frame 3 ^{In 2} ~~from the~~ direction perpendicular to its winding axis C1. Accordingly, the electric wire 99 is easily supplied and can be easily wound around the coil winding frame 3. OK

As shown in Fig. 2, each coil winding frame 3 is arranged ~~in a circumferential shape on the outer circumferential face~~ ^{se} of the ~~index holder 22.~~ ^{the} In this example, ~~each~~ coil winding frame 3 ^{are} ~~is~~ arranged ~~in a radiating shape~~ (approximately at ~~the~~ equal interval^s on the outer circumferential face of the index holder 22. Further, in this example, four coil winding frames 3 are arranged to form the ~~joining pole~~ ^{multipole} coil 9 ~~constructed by~~ joining four monopole coils 90.

As shown in Figs. 3 and 4, each coil winding frame 3 has an inside winding frame portion 31 attached to the index holder 22, and an outside winding frame portion 32 ^{pivotaly attached} ~~arranged so as to~~ ~~be opposed to this~~ ^e inside winding frame portion 31. The outside winding frame portion 32 can be moved so as to change the distance between the outside winding frame portion 32 and the inside winding frame portion 31 ^{for} ~~between a winding position 301 in winding~~ the ~~above~~ electric wire 99 as shown in Fig. 3 and a ^{coil release} ~~separating~~ position 302 ^{for} ~~in~~ separating the monopole coil 90 from the coil winding frame 3 after the ^{completion of} ~~above~~ winding operation ~~is performed~~ as shown in Fig. 4. Further, the diameter of the outside winding frame portion 32 ⁵ ~~is~~ stepwise increased ^{in a direction perpendicular to} ~~toward the advancing~~ and away ✓

~~direction separated~~ from the above, turning arm 21.

As shown in Fig. 3, when the outside winding frame portion 32 is set ~~to be located~~ in the winding position 301, the state in which the outside diameter of the coil winding frame 3 ~~is~~ ⁵ ~~stepwise increased toward the above advancing direction can be formed~~ ^{away from the turning arm 31. Accordingly,} ~~It is possible to form the monopole coil 90 in which the winding diameter of the electric wire 99 is increased toward the advancing direction.~~ ^{with its} ~~It is also possible to form the monopole coil 90 having the winding diameter of a regular size determined by the distance between the outside winding frame portion 32 and the inside winding frame portion 31.~~ ^{ing away from the turning arm 21.}

When the ^{multi-pole} ~~joining pole coil 9 constructed by each monopole coil 90~~ is inserted and arranged in the slot ⁵ 810 in the stator core 81, the large ^{side of the above} ~~side of the above~~ winding diameter is located ²¹ ~~on the opening side of the slot 810 for performing the insertion and arrangement so that this joining pole coil 9 can be inserted and arranged.~~ ^{of} ~~Coil end portion formed by projecting each monopole coil 90, from both axial end portions of the stator core 81, can be reduced in size by moving and deforming this coil end portion toward the outer direction of the stator core 81 from the portion located on the above opening side. Namely, the length of each monopole coil 90 approaches the length of a required minimum limit and the coil end portion can be reduced in size by forming each monopole coil 90 having the winding diameter increased from one side to the other side.~~ ^{which project are bending them so as to extend outward relative to}

As shown in Fig. 4, when the outside winding frame portion 32 is set ~~to be located~~ ^{release} in the separating position 302, it is ~~possible to form a state in which~~ the outside diameter of the coil winding frame 3 is reduced ~~toward~~ ⁱⁿ the ~~above~~ ^{downward} advancing direction. Each monopole coil 90 can be easily ~~separated~~ ^{removed} by reducing the distance between the outside winding frame portion 32 and the inside winding frame portion 31.

As shown in Figs. 3 and 4, each coil winding frame 3 ~~is~~ ^{has} constructed in this example such that a handle 35 ~~is arranged~~ ^{for} in this coil winding frame 3 and is manually advanced and retracted ~~is fixed in~~ ^{is, fixed in} ~~ed position or the~~ ^{ed position or the} and the advancing ~~retracting~~ ^{retracting} position ~~is fixed~~ ^{is, fixed} by a positioning pin 34. ~~In addition to this,~~ ^{Alternatively,} each coil winding frame 3 can be ~~also~~ ^{retracted} advanced and retracted by using a cylinder or a motor, etc.

In this example, ~~A~~ ^{pivotaly mounted} cam 33 is ~~rotatably arranged~~ ^{of} in each inside winding frame portion 31 in each coil winding frame 3. As shown in Fig. 3, the ~~winding~~ ^{is raised} position 301 is ~~formed~~ ^{established} when the cam 33 ~~moves~~ ^{is raised} toward each outside winding frame portion 32. As shown in Fig. 4, the ~~above~~ ^{release} separating position 302 is ~~assumed~~ ^{is lowered (falls)} when the cam 33 ~~falls~~ ^{The} toward each inside winding frame portion 31. ~~In addition to this,~~ ^{Alternatively,} the outside winding frame portion 32 can be ~~also~~ ^{release} moved by using a cylinder or a motor ~~also~~ between the winding position 301 and the ~~separating~~ ^{release} position 302.

As shown in Figs. 1 and 2, ~~a~~ connecting wire winding frame 341 for winding a connecting wire 995 connecting the respective

are provided (alternate with)
monopole coils 90 to each other is arranged between the respective
coil winding frames 3 ^{around} the ~~above~~ index holder 22. In ^{the embodiment} this
~~depicted in Figs. 1 and 2~~
example, three connecting wire winding frames 41 are arranged
between the ~~above~~ four coil winding frames 3. ^A The connecting
wire 995 of a prescribed length ^{is} can be formed between the monopole
coils 90, ^{on} formed in the respective coil winding frames 3, by winding
the electric wire 99 around the connecting wire winding frame
41 (see Fig. 11).

embodiment
As shown in Figs. 1 and 2, in this example, a lead winding
frame 42 is arranged between a first coil winding frame 3a for
^{forming the coil}
firstly winding the electric wire 99 and a fourth coil winding
^{forming the coil}
frame 3d for finally winding the electric wire 99. The lead
^{a predetermined length of}
winding frame 42 is arranged to secure the lead wire 996 of
~~a predetermined length in advance~~ by winding the ~~above~~ electric
wire 99 before the electric wire 99 is wound around the first
coil winding frame 3a. This lead wire 996 is ~~the electric wire~~
~~99~~ connected to the ~~winding end portion of~~ ^{the} a first monopole
coil 90a formed ^{on} in the first coil winding frame 3a (see Fig.
11).

embodiment
In this example, the sectional shape of the lead winding
frame 42 is approximately ~~set to a~~ circular ~~shape~~, and the lead
wire 996 of a predetermined length can be ~~stably~~ secured ~~in~~
~~to~~ the ~~winding end portion of~~ the first monopole coil 90a without
~~generating bending, etc.~~ ^{of} in the electric wire 99.

Similar to the ~~above~~ coil winding frame 3, the ~~above~~

connecting wire winding frame 41 and the lead winding frame 42 can be ~~also~~ advanced and retreated ^{SC} in ² the direction ^{along} of the ~~above~~ ^{of} turning central axis C2 with respect to the ~~above~~ index holder 22, and are advanced in ^{a direction away} the advancing direction separated ^{so as to project axially beyond} from the ~~above~~ turning arm 21 with respect to the remaining coil winding frames 3 and connecting wire winding frames 41, and can be projected from the remaining coil winding frames 3 and connecting wire winding frames 41.

As shown in Figs. 1 and 2, the above turning arm 21 can be turned in both ^{clockwise} ~~the~~ (normal) and ^{counter-clockwise} ~~(reverse)~~ rotating directions ^{about} with the ~~above~~ turning central axis C2 as a center. In this ^{embodiment} example, the joining pole coil 9 ~~constructed by joining~~ ³ four monopole coils 90 wound in the same winding direction, ~~is formed.~~ Therefore, the ^{on} rotating direction ^{of} of the turning arm 21 at the ⁱⁿ winding time around the ~~above~~ coil winding frame 3 is ^{on} reverse ^{of} to the ^{on} rotating direction ^{of} of the turning arm 21 ⁱⁿ at the winding time around the ~~above~~ connecting wire winding frame 41. ^{Therefore,} ~~The~~ ^{to} ~~above~~ coil forming device 1 is alternately rotated in both the normal and reverse ~~rotating~~ directions ^{to} and form ~~the above joining~~ multipole coil 9.

In the following description, the ^{rotational} ~~turning~~ direction of the turning arm 21 at the ⁱⁿ winding time around the coil winding frame 3 is ^{referred to as} ~~called~~ the normal ^{the wire 99} rotating direction, ^{whereas the rotations} and the turning direction of the turning arm 21 ⁱⁿ at the winding time around the connecting wire winding frame 41 and the lead winding frame

referred to as
42 is called the reverse ~~rotating~~ direction.

A turning device^(not shown) for turning the ~~above~~ turning arm 21 ^{about} with its turning central axis C2 as a center is ^{provided on} ~~arranged in~~ the ~~above~~ base frame, although this turning device is omitted in the drawings. The turning central axis C2 is connected to the turning device. In this ^{embodiment} example, the turning device is constructed so as to be manually turned by arranging a handle ^{provision of} on the turning arm 21. ^{Alternatively,} ~~in addition to this,~~ various kinds of motors or an index cylinder, ^{ing} ~~etc.~~ operated by using an electricity operation, oil pressure or air, etc. can be ~~also~~ ^{for} used as the turning device. ^{the turning arm 21.}

^{method} A ~~coil forming process~~ for forming the ^{multiple} ~~joining pole~~ coil 9 by using the above coil forming device 1 will next be explained.

In this coil forming process, the monopole coil 90 is formed by sequentially performing ^{the steps of} ~~an~~ ^{ing} ~~index~~ process, ~~projecting~~ process and ~~winding~~ ^{as} ~~process~~ described below, with respect to each coil winding frame 3 by using the above coil forming device ^{forming} 1, and the ^{multiple} ~~joining pole~~ coil 9 ^{in which the} ~~constructed by joining this~~ monopole coils 90 ^{are joined.} ~~is formed.~~

^{starting operation of} As shown in Fig. 1, in the ~~above~~ coil forming device 1, the above lead winding frame 42 is located in the position closest to the turning central axis C2 ^{as} in the ~~above~~ turning arm 21 ^{in its initial position} ~~in the~~ original position of the ~~above~~ index holder 22. In this ^{initial} ~~original~~ position, the winding axis C1 in the lead winding frame 42 is approximately ^{aligned with} ~~conformed to the~~ turning central axis C2

of
in the turning arm 21.

To start the winding
As a pretreatment process, the lead winding frame 42 is
advanced ^{downward} so that it is ^{relative to the} projected as compared with each coil winding
frame 3 and ^{the} each connecting wire winding frame 41. ^(See Fig. 5) Then, the
electric wire 99 is ^{fed} supplied to the ~~above~~ lead winding frame
42 and the turning arm 21 is turned in the reverse ~~rotating~~
direction so that the electric wire 99 is wound around the lead
winding frame 42 and the lead wire 996 of a predetermined length
is formed.

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(fed)
The ~~above~~ electric wire 99 is supplied ~~from the transversal~~
^{to the} direction of the ~~above~~ coil forming device 1, ^{in a} i.e., from the
direction ^{axis} perpendicular to a winding face for winding the electric
wire 99 around each coil winding frame 3, ^{of a} each connecting wire
winding frame 41, ^{or} and the lead winding frame 42.

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Next, as shown in Fig. 5, ^{in an} as the ^{ing step} above index process,
the index holder 22 is rotated ^{through} by a predetermined angle and
the winding axis C1 of the first coil winding frame 3a is ^{brought into}
^{alignment with} approximately ~~conformed to~~ the ~~above~~ turning central axis C2, i.e.

No 11

~~Further, as the above projecting process, the first coil~~
winding frame 3a is advanced ^{to the} and projected and the lead winding
frame 42 is ^{re}retracted.

As shown in Fig. 6, as the ⁱⁿ above ^{described} winding process, the
electric wire 99 is supplied to the first coil winding frame
3a and the turning arm 21 is turned in the normal ^{of rotation} rotating direction,
and the first monopole coil 90a is formed by winding the electric

wire 99 ⁱⁿ plural ^{turns} times around the first coil winding frame 3a. The outside winding frame portion 32 ^{of} the first coil winding frame 3a is located in the ~~above~~ ^{above} winding position 301, ~~and a~~ ^{with} ~~state in which~~ the outside diameter of this first coil winding frame 3a ~~is~~ ^{ing} stepwise increased ^{in the downward} toward the ~~above~~ ^{above} advancing direction ~~is formed~~. ^{In this manner} It is thus possible to form the monopole coil 90 ~~in which the winding diameter of the electric wire 99~~ ^{has its} ~~is~~ ^{in the downward} increased toward the advancing direction.

Next, as shown in Fig. 7, the ~~above~~ ^{ing step repeated} index process is again ~~performed~~ and the winding axis C1 of a first connecting wire winding frame 41a is ^{brought into} approximately ^{alignment with} ~~conformed to the above~~ turning central axis C2 by rotating the index holder 22 ^{through} a predetermined angle. Further, ~~as the projecting process~~, the first connecting wire winding frame 41a is ^{lowered} ~~advanced and projected~~ and the first coil winding frame 3a is ^{so} ~~repeated~~.

^{to form} Next, ~~as the connecting wire winding process~~, the electric wire 99 is supplied to the first connecting wire winding frame 41a and the turning arm 21 is turned in the reverse ~~rotating~~ ^{of rotation} direction, and the ~~above~~ ^{above} connecting wire 995 is formed by winding the electric wire 99 around the first connecting wire winding frame 41a.

Next, as shown in Fig. 8, the ~~above~~ ^{ing step is repeated} index process is again ~~performed~~ and the index holder 22 is rotated ^{through} by a predetermined angle ^{to bring} and the winding axis C1 of a second coil winding frame 3b ^{into} is approximately ^{alignment with the} ~~conformed to the above~~ turning central axis

C2. ~~Further, as the projecting process,~~ ^{The} the second coil winding frame 3b ^{step then lowers} is ~~advanced and~~ ^{to a} projected and the first connecting wire winding frame 41a is ~~retracted.~~ ^{position} ~~retracted.~~ ^{as}

As shown in Fig. 9, the above winding process is then ~~again performed~~ ^{repeated} and the electric wire 99 is supplied to the second coil winding frame 3b and the turning arm 21 is turned in the normal ~~rotating~~ ^{to form} direction and the second monopole coil 90b ~~is formed by winding the electric wire 99 plural times around~~ ^{is formed by winding the electric wire 99} the second coil winding frame 3b.

Thereafter, as shown in Fig. 10, ~~similar to the above~~ ^{repeating} ~~case,~~ each connecting wire 995 is formed by performing the above ~~index process,~~ ^{repeating} the projecting process and the connecting wire forming ~~process with respect to~~ ^{steps for} a second connecting wire winding frame 41b and a third connecting wire winding frame 41c. A third monopole coil 90c and a fourth monopole coil 90d are formed by ~~performing the above index process,~~ ^{repeating} the projecting process ^{described} and ~~the winding process with respect to~~ ^{steps on} a third coil winding frame 3c and a fourth coil winding frame 3d.

As shown in Fig. 11, the ~~joining pole coil 9~~ ^{multi} ~~constructed~~ ^{is} by joining the first to fourth monopole coils 90a to 90d by the ~~above~~ ^{Fig. 11 schematically} respective connecting wires 995. ~~This figure~~ ^{is} ~~is an explanatory view typically showing a state in which the~~ ^{shows} ~~respective~~ ^{respectively} monopole coils 90a to 90d are formed in the above ~~on first to fourth coil winding frames 3a to 3d and the joining~~ ^{at all of the} ~~multi pole coil 9 is formed in the entire respective winding frames~~

3a to 3d, 41a to 41d, 42.

^{operation of}
In the above coil forming device 1, the above electric wire 99 is wound around the coil winding frame 3 closest to the ~~above~~ turning central axis C2 ^{to form} and the above monopole coil 90 is ^{rotating} formed by ~~turning~~ the ~~above entire plural coil winding frames 3~~ ^{by the above turning arm 21 together with 21}

~~The electric wire 99 is wound by entirely rotating the plural coil winding frames 3 and the index holder 22 arranged in the above turning arm 21 by turning this turning arm 21.~~
Therefore, no electric wire 99 is wound ^{by} while rotating a winder ^a ~~etc.~~ ^{around} from the outer circumference of the fixed winding frame as in the conventional case. Accordingly, each monopole coil 90 can be formed ^{on a} in each coil winding frame 3 ^(without almost completely) generating distortion ^{of} in the electric wire 99.

^{because} Further, ^a the winding axes C1 of the coil winding frames 3 for winding the above electric wire 99 can be sequentially ^{brought into} approximately ^{alignment with} ~~conformed to~~ the turning central axis C2 of the above turning arm 21 by rotating the ~~above~~ index holder 22 ^{as}.
~~Therefore, although the above coil forming device 1 has the plural coil winding frames 3 to form the joining pole coil 9,~~
the electric wire 99 can be wound ^{on a} in a state in which the coil winding frame 3 ^{which} for performing the winding operation is not ^{, or only slightly eccentric, relative to} eccentric ^a so much from the turning central axis C2.

After ^a the monopole coil 90 is formed in one of the coil winding frames 3, the ~~above~~ index holder 22 is rotated and the

winding axis C1 of the next^{adjacent} coil winding frame 3 ^{is brought into} adjacent to the above one of the coil winding frames 3 is approximately ^{to form additional} alignment with the ^{as described above.} conformed to the above turning central axis C2, and the monopole coil 90 can be formed similarly to the above case.

Therefore, the ~~above~~ electric wire 99 can be ^{constantly fed} (supplied) from an approximately ^{in 2} constant direction perpendicular to the winding axis C1 of the coil winding frame 3 ^{currently in use in} for performing the winding operation. Thus, the electric wire 99 can be stably wound around each coil winding frame 3 ^{almost completely without generation of torsion} Therefore, the monopole coil 90 almost not generated in the above torsion can be stably formed with respect to any coil winding frame 3. Thus, it is possible to stably form ^{2nd multi} the joining pole coil 9 in which no ^{stably formed} torsion is almost generated.

Second Embodiment

(Embodiment 2)
~~As shown in Fig. 12~~ ^{As shown in Fig. 12, 21, 22}

As shown in Fig. 13, ^{the} a coil forming insertion device 5 ^{and} second embodiment includes of this ~~example has~~ a winding jig 2 and an inserter jig 6. The winding jig 2 forms the ^{multiple} joining pole coil 9 ^{formed} constructed by joining plural monopole coils 90 ^{axially aligned in} constructed by winding the electric wire 99 in a loop shape. The inserter jig 6 is opposed to this winding jig 2 and receives the ^{multiple} above joining pole coil 9 and inserts and arranges this ^{multi-pole} joining pole coil 9 in plural slots 810 formed on the inner circumferential face of the stator core 81.

As shown in Fig. 12, the ~~above~~ winding jig 2 has plural

coil winding frames 3 and the ~~above~~ inserter jig 6 has plural coil receiving portions 62 for respectively receiving the ~~above~~ ~~respective~~ monopole coils 90 from the ~~above~~ ~~respective~~ coil winding frames 3.

As shown in Fig. 16, the coil forming insertion device 5 ^{has} is ~~constructed such that~~ each coil receiving portion 62 ~~is~~ opposed to ~~each~~ ² coil winding frame 3, and the ~~joining~~ ^{multi} pole coil 9, constructed by joining ~~each~~ ^{the} monopole coil 90, ~~wound around~~ ^{transferred} each coil winding frame 3 is moved and mounted from the winding jig 2 to the inserter jig 6.

~~This construction will next be explained in detail.~~

As shown in Figs. 1 and 2, in the above winding jig 2, the plural coil winding frames 3 ~~for forming the above monopole~~ coil 90 by winding the above electric wire 99 are arranged at ^{approximately radial} ~~about~~ the same distance from the central point of the winding jig 2. Further, in the winding jig 2, the ~~respective~~ winding axes C1 ~~for winding the above electric wire 99 in the respective~~ coil winding frames 3 are approximately parallel to each other.

On the other hand, as shown in Figs. 12 and 13, the above inserter jig 6 ^{is axially extendable} has ~~a pushing out insertion~~ core 61 for pushing ~~out~~ the ~~above~~ ^{multi} joining pole coil 9 toward the ~~above~~ ⁵ slot 810 of the above stator core 81 and inserting this ~~joining~~ ^{multi} pole coil 9 into ~~this~~ ⁵ slot 810. The above plural coil receiving portions ^{elements} 62 are arranged on the outer circumferential face of the ~~pushing out insertion~~ core 61 and respectively receive ~~each~~ ²

✓

monopole coil 90 from each coil winding frame 3.

In operation of the
The coil forming insertion device 5, ~~is constructed as~~
and
shown in Figs. 12 and 14. ~~Namely,~~ *multi* when the ~~above joining pole,~~
transferred
coil 9 is ~~moved and mounted~~ from the ~~above~~ winding jig 2 to
the ~~above~~ inserter jig 6, each coil receiving portion 62 is
opposed to the tip face 311 of ~~each~~ *a* coil winding frame 3 in
alignment with its
the direction of the ~~above~~ winding axis C1, ~~and each coil winding~~ *paired*
frame 3 and ~~each~~ coil receiving portion 62 are connected to
To form
each other, ~~and each of each coil winding frame 3 and each coil~~
~~receiving portion 62 forms a moving mounting route 60 for moving~~ *transfer*
~~and mounting each monopole coil 90.~~ *as a*

As shown in Figs. 3 ~~and 12~~, each coil winding frame 3
has a ~~fitting concave portion 312 for fitting the tip portion~~ *slot* *receiving*
621 of ~~each~~ *a* coil receiving portion 62 *of* in the ~~above~~ inserter
jig 6, ~~on the above tip face 311 of the coil winding frame 3.~~

embodiment
In this ~~example~~, this fitting concave portion 312 is ~~formed~~ *slot* *extends parallel to*
winding axis C1 from
on the tip face 311 of each ~~inside~~ winding frame portion 31,
~~of each coil winding frame 3.~~

slot
As shown in Fig. 14, ~~this fitting concave portion 312~~
has *sufficient to allow*
~~is formed at a depth able to insert and arrange the coil receiving~~
to extend completely through
portion 62 ~~within the entire ring of the monopole coil 90 wound~~
In other words,
around the coil winding frame 3. ~~Namely, the fitting concave~~
slot *extends*
portion 312 is ~~deeply formed from the tip face 311 of each coil~~
further than *of coil 90.*
winding frame 3 ~~in comparison with the winding depth from the~~
~~tip face 311 of each coil winding frame 3 to the position for~~

~~winding the above electric wire 99.~~

As shown in Figs. 12 and 14, each coil winding frame 3 and each coil receiving portion 62 can be connected by fitting the tip portion 621 of ^{the} each coil receiving portion 62 into the ^{receiving slot} fitting concave portion 312 of ^a each coil winding frame 3. Further, the ^{multipole} ~~joining pole~~ coil 9 can be ^{transferred} ~~moved and mounted~~ from the winding jig 2 to the inserter jig 6 in this ^{connected} ~~fitting~~ state.

~~When this fitting is performed, the tip portion 621 of each coil receiving portion 62 is necessarily inserted and arranged within the ring of each monopole coil 90 in each coil winding frame 3.~~

As shown in Figs. 12 and 13, the above winding jig 2 has ^{a piston slidably mounted,} ~~an expelling core 23~~ arranged so as to be advanced and retreated ^{ac} ~~within the center~~ on the inner circumferential side of each coil winding frame 3, ^{for forcing the} ~~to expel the above~~ ^{multipole} ~~joining pole~~ coil 9 ^{onto} to the above inserter jig 6. As shown in Fig. 16, this ^{piston} ~~expelling core 23~~ ^{serves to push a} can push out ^a ~~each monopole coil 90~~ ^{off of a coil winding frame onto a} delivered to each coil receiving portion 62 ^{to} until a predetermined position ^{on} in the inserter jig 6, by advancing the ^{piston} ~~expelling core 23~~ in the advancing direction ~~(the advancing direction separated from the above turning arm 21,~~ ^{away} ~~on the side~~ ^{opposed to the above inserter jig 6.}

^{second embodiment} ~~In this example,~~ ^{mentioned} as shown in Fig. 18, the above predetermined position is set ^{so that} to a prescribing position ^{multi} when the ~~joining pole~~ coil 9 ^{can be transferred} is inserted and arranged from the inserter jig 6 ^{into} to the slot 810 of the ~~above~~ ^{multipole} stator core 81. Therefore, after the ~~joining~~

~~pole~~ coil 9 is ^{transferred to} moved and mounted ^{on} to the inserter jig 6, the ~~joining pole~~ ^{multi} coil 9 in this ~~moving and mounting~~ ^{ed} state can be inserted and ~~arranged in the slot 810 of the stator core 81.~~ ^{into a}

As shown in Fig. 12, the above inserter jig 6 has plural guide ~~portions~~ ^s 63 arranged ^{in approximately} toward ~~about~~ the same direction ^{and} as the ~~forming direction of the coil receiving portion 62 between~~ ^{arranged} the ~~respective~~ coil receiving portions 62. As shown in Fig.

^{These} ~~this~~ guide portion 63 ^s ~~is~~ ^{are} opposed to teeth 811 located between ^{and defining} the ~~respective~~ slots 810 of the ~~above~~ stator core 81 and guides the insertion and arrangement of the ~~above joining pole coil~~ ^{multiple} 9 into ~~each~~ ^{the} slot ^s 810.

As ^{shown} in Fig. 12, an insertion clearance 64 ^{for receiving} ~~able to~~ ^{provided} ~~insert~~ the electric wire 99 ^{of} in the monopole coil 90 is ~~formed~~ between each guide ~~portion~~ 63 and ~~each~~ ^{the adjacent} coil receiving portions 62 ^{on} adjacent to both sides of ^{the} this guide ~~portion~~ 63. When the electric wire 99 ^{of} in each monopole coil 90 is inserted into ^a the ~~above insertion clearance 64 and is inserted and arranged in~~ ^{an} each coil receiving portion ^s 62, each monopole coil 90 is constructed so as to ^{connect} ~~mix~~ this electric wire 99 with the electric wire 99 in the adjacent monopole coil 90. Thus, the electric wire 99 in each monopole coil 90 can be reliably inserted and arranged in the slot ^s 810 of ~~each~~ stator core 81.

As shown in Fig. 20, each ^{piston} ~~pushing out insertion core~~ 61 can be advanced and retreated ^{as} ~~with respect to each~~ ^{relative to the} coil receiving portion ^s 62. When ~~each~~ ^{the} coil receiving portion ^s 62 and ~~each~~ guide ^s

in position aligned with
~~portion 63~~ are ~~opposed to~~ the inner circumferential side of
the stator core 81, the monopole coil 90 ^{held by the} ~~held to each coil~~ receiving
portion 62 can be inserted ^{into respective} ~~and arranged in each slot~~ 810 by
advancing the ^{piston} ~~pushing-out insertion core~~ 61 toward the stator
core 81.

A coil forming insertion method for ~~performing a coil~~
~~transfer~~ ~~moving and mounting process~~ and a coil insertion process will
next be explained. In the coil ^{transfer step} ~~moving and mounting process~~,
the ^{multi} ~~joining pole coil~~ 9, formed by performing the coil forming
~~process shown in the above embodiment~~, is once moved and mounted
to the inserter jig 6. In the coil insertion ^{step} ~~process~~, this joining
^{multi} ~~multi~~ pole coil 9 is inserted ^{into the respective} ~~and arranged in each slot~~ 810 of the
stator core 81 ^{by} ~~from~~ the inserter jig 6. *according to the method of the first transfer step*

~~In this example, the coil forming process is similar to~~
~~that in the above embodiment 1.~~

^{transfer step}
Next, the coil ~~moving and mounting process~~ for moving
^{multi} ~~and mounting the joining pole coil~~ 9 ~~formed by performing the~~
~~coil forming process from the above winding jig 2 to the above~~
inserter jig 6 will be explained.

^{transfer step}
As shown in Fig. 12, in this coil ~~moving and mounting~~
^{multi} ~~process~~, the ~~above joining pole coil~~ 9 is moved and mounted
from the winding jig 2 to the inserter jig 6 ~~by~~ using the coil
^{and} ~~forming insertion device 5, having the above winding jig 2 and~~
~~the inserter jig 6.~~ *transfer step*

^{transfer step}
Namely, ^A ~~As shown in Fig. 13, in the coil moving and mounting~~

process, the entire winding jig 2 ~~forming the above joining~~
~~pole coil 9~~ is first advanced toward the above inserter jig

6. At this time, ~~in each coil winding frame 3~~ ^{has its} ~~in the winding~~
~~jig 2, each outside winding frame portion 32~~ is located in the
~~above winding position 301~~ ^{(Fig. 3) with} ~~and tension is applied to each monopole~~
~~coil 90. Each monopole coil 90 is maintained so as not to break~~
~~the state after the above winding operation is performed.~~ ^{avoid} ^{has been completed}

As shown in Fig. 14, the tip ~~portion 621~~ ^{of} in each coil
receiving portion 62 of the inserter jig 6 is fitted into the
~~fitted concave portion 312~~ ^{slot} ^{of 2} in each coil winding frame 3 of
the winding jig 2. Each coil winding frame 3 and each coil
receiving portion 62 are connected by this fitting, and ^{operation 3} ~~each~~
~~moving and mounting route 60~~ ^{transfer path (surface)} ~~for moving and mounting each monopole~~
~~coil 90 is formed by each coil winding frame 3 and each coil~~
~~receiving portion 62~~ ^{thereby} ^{(connecting) operation}

^{In} ^{described} At the above fitting time, the tip portion 621 of each
coil receiving portion 62 is inserted and arranged within the
~~entire ring of each monopole coil 90~~ ^{center opening} ~~in each coil winding frame~~

^{the}
Next, as shown in Fig. 15, ~~each~~ outside winding frame
portion 32 ^{of the} ~~in each~~ coil winding frame 3 is moved to the ~~above~~
~~separating position 302~~ ^{(Fig. 4) whereby} ~~as the separating process.~~ At this time,
the outside diameter of ~~each~~ ^{the} coil winding frame 3 ~~is shortened~~
~~by forming a state in which this outside diameter is reduced~~
~~toward the above advancing direction.~~ ^{in the direction away from the turning arm 21.} Therefore, each monopole

coil 90 ^{can be} separated from ^{the} each coil winding frame 3. ^{on which it is mounted.}

Next, as shown in Fig. 16, the ^{piston} expelling core 23 of the winding jig 2 is advanced toward ~~the direction of~~ the inserter jig 6. ^{to push} At this time, ^{the} each monopole coil 90, wound around the outer circumference of ^{the} each coil winding frame 3, ^{it reaches} is pushed out until the ^{ed} above prescribing position abutting on the ~~pushing out~~ ~~insertion~~ core 61 of the inserter jig 6.

At this time, ^{a transfer path (surface)} while each moving and mounting route 60 ^{established} is maintained within the ^{central opening} ring of each monopole coil 90, ^{so that} each monopole coil 90 can be ^{transferred its} delivered from each coil winding frame 3 to ^a each coil receiving portion 62.

Thereafter, as shown in Fig. 17, the winding jig 2 is ^{so and thereby} retreated in the retreating direction separated from the inserter jig 6, and the joining pole coil 9 ~~constructed by joining each~~ monopole coil 90 is ^{on} completely moved and mounted to the inserter jig 6.

The coil insertion process will next be explained.

As shown in Figs. 18 to 20, in ^{the} this coil insertion ^{step} process, the ^{multi} joining pole coil 9 held ^{by} to the ~~above~~ inserter jig 6 is inserted and arranged ^{within} in the plural slots 810 formed on the inner circumferential face of the stator core 81.

~~Namely,~~ ^{as} shown in Figs. 18 and 19, ^{are inserted into position} each coil receiving portion 62 of the inserter jig 6 ^{is} first oppositely arranged on the inner circumferential face ~~side~~ of the stator core 81. ~~in the coil insertion process.~~ At this time, the above respective

guide ~~portions~~ 63 are ^{ing} ~~oppositely~~ arranged ~~in the~~ respective teeth 811 between the respective slots 810 on the inner circumferential face of the stator core 81.

Next, as shown in Fig. 20, the ~~above pushing-out insertion~~ core 61 is advanced toward the ~~above~~ stator core 81. At this time, the electric wire 99 ^{as} in each monopole coil 90 held ^{on} to ~~the~~ each coil receiving portion 62 is inserted and arranged in each

slot 810. When the tip of the ~~pushing-out insertion~~ core 61 ^{extends beyond} ~~exceeds~~ the tip of each coil receiving portion 62 and is ^{into} advanced, each monopole coil 90 is inserted and arranged within

^a each slot 810, and the ~~joining pole~~ ^{multipole} coil 9 ^{is thereby incorporated} can be assembled into the stator core 81.

Thus, ^a the stator ^{for} in a three-phase motor, ^{including} constructed by U-phase, V-phase and W-phase ^{is} has been manufactured ^{in accordance} by executing the above embodiments ^{first and second} ~~1 and 2~~. In this example, the winding ^{embodiment} jig 2 is set to have four coil winding frames 3 and three connecting wire winding frames 41, and the inserter jig 6 ^{has} is set to have eight coil receiving portions 62 and eight guide ^{portions} 63.

A four-pole coil as the ^{multi} ~~joining pole~~ coil 9 ^{is formed} constructed by joining four monopole coils 90 ^{on} is formed in the winding jig 2

^{repeated to assemble} ~~transferred and inserted~~ 2, and are moved and mounted to the inserter jig 6 ^{twice}. ^{This process is then} The two four-pole coils are assembled into the stator core 81 ^{from} the inserter jig 6, and the U-phase ^{is formed} constructed by an eight-pole coil ^{is formed} by joining the two four-pole coils. With respect ^{an} to the V-phase and the W-phase, a structure constructed by the

eight-pole coil is similarly formed by joining two four-pole coils ~~by performing the above assembly.~~ ⁱⁿ ~~described~~ ^{manner,}

In the above coil forming insertion device 5, the joining pole coil 9 is formed in the above winding jig 2, and each monopole coil 90 is reliably delivered to each coil receiving portion 62, and can be moved and mounted to the inserter jig 6 as the joining pole coil 9.

~~Namely,~~ ^{Thus, by use of} the plural coil winding frames 3 ~~are~~ arranged in the ~~above~~ winding jig 2, and the joining pole coil 9 ~~can~~ ^{to form 2} be formed by forming the monopole coil 90 ^{on} in each coil winding frame 3 ~~in this winding jig 2.~~ ^{the} Therefore, each monopole coils ^{with their relative} ~~can be formed in each coil winding frame 3 in which the mutual~~ position ^{relation is} ~~is~~ fixed, and it is possible to ^{Six} ~~stabilize~~ the length of the connecting wire ³ 995 formed between the monopole coils 90 ~~wound around each coil winding frame 3.~~

Further, ^{with} ~~the above inserter jig 6~~ has each coil receiving portion 62 ~~in which the tip portion 621 is fitted to the fitting concave portion 312 of each coil winding frame 3.~~ When each coil winding frame 3 ^{connected with} and each coil receiving portion 62 ~~are~~ connected to each other, each coil winding frame 3 and each coil receiving portion 62 ~~can form each moving and mounting route 60.~~ ^{the} Therefore, when each monopole coil 90 ^{are transferred} ~~is delivered~~ from ^{the} each coil winding frame 3 to ^{the} each coil receiving portion 62, each monopole coil 90 can be reliably ^{moved} ~~delivered~~ along each ^{transfer path} ~~moving and mounting route 60 while maintaining each moving and~~

central opening

mounting route 60 within the ~~ring~~ of the monopole coil 90.

Each monopole coil 90 can be approximately simultaneously ~~delivered~~ ^{transferred} to the coil receiving portion ^s 62. Therefore, in this ~~transfer~~ ^{transfer} delivery, there is almost no case in which the winding order

of each electric wire 99 in ^a each monopole coil 90 is different from the winding order in which the above winding operation

is performed. ^{In other words} Namely, when ^{the} each monopole coil ^s 90 having their ⁱⁿ

winding diameter increased from the above one side to the other ^{are transferred to} ^{on} ^{the} ~~side is moved~~ and mounted to the ~~above~~ inserter jig 6, ^{its} winding ^{of the wire on each} order is not changed and the monopole coil 90 can be ~~moved~~ ^{transferred} and mounted ^{with} in a state in which each electric wire 99 is aligned ^{in proper alignment}.

Therefore, ^{the multipole} ~~this joining pole~~ coil 9 can be ^{transferred} ~~moved and mounted~~ from the winding jig 2 to the inserter jig 6 ^{without almost} changing the ~~forming~~ state of the ^{multi} ~~joining~~ pole coil 9.

Abstract

~~A coil forming~~^{and} ~~insertion device 5~~^{apparatus includes} has plural coil winding frames ~~3~~^{3'}, a winding jig ~~2~~^{2'} for forming a ~~joining~~^{mult} pole coil ~~4~~^{4'}, plural coil receiving portions ~~62~~^{62'}, and an inserter jig ~~16~~^{16'} for inserting and arranging the ~~joining~~^{mult} pole coil ~~4~~^{4'} in ~~a slot~~⁵ ~~82~~^{82'} of a stator core ~~84~~^{84'}. The coil forming ~~insertion device 5~~^{and apparatus has} is ~~constructed such that each coil receiving portion 62 is opposed~~^{is formed} to ~~each coil winding frame 3~~^{connecting the}, ~~and the joining pole coil 4 is constructed~~⁵ by ~~joining each monopole coil 80 wound around each coil winding frame 3~~^{on the} ~~is moved and mounted~~^{and the multipole coil is transferred} from the winding jig ~~2~~^{2'} to the inserter jig ~~16~~^{16'}.